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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : A47J 31/30	A1	(11) International Publication Number: WO 95/16377 (43) International Publication Date: 22 June 1995 (22.06.95)
(21) International Application Number: PCT/HU93/00070		(81) Designated States: JP, KZ, RO, RU, UA, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).
(22) International Filing Date: 13 December 1993 (13.12.93)		
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(54) Title: METHOD OF AND APPARATUS FOR PREPARING A FROTHY COFFEE BEVERAGE, ESPECIALLY FOR HOUSEHOLD USE		
(57) Abstract		
In a method of preparing a frothy coffee beverage, especially for household use, comprising the steps of heating water in a closed space compartment, generating steam from the water, pressing water by the means of the steam generated through a batch of ground coffee for preparing a basic coffee beverage and accelerating the stream of the prepared basic coffee beverage to speed in the range from about 2 m/s to about 30 m/s before collecting it as a frothy coffee beverage at the outlet of the space compartment, the novelty lies in carrying out the heating step up to transferring a limited amount of heat energy to the water by creating conditions limiting heat transfer in water and/or by stopping the heating process during preparing the basic coffee beverage and the pressing step by the application of low pressure steam and at least one opening capable of widening and in arranging an impacting surface in the space for collecting the accelerated basic coffee beverage leaving the outlet of the space compartment.		
The proposed apparatus comprises a vessel (1), a cover (12) sealing the vessel (1), a holder (2) for coffee, at least one filtering element (10), an outlet pipe (15) and a constriction on a part of the length of the outlet pipe (15) for accelerating a stream of a pressurized liquid to speed in the range from about 2 m/s to 30 m/s, wherein the outlet pipe (15) is equipped with a self-regulating membrane valve system having at least one opening (24) of non-linear operation capable of closing the outlet pipe (15) until pressure of the pressurized liquid reaches a threshold value.		

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**METHOD OF AND APPARATUS FOR PREPARING A FROTHY COFFEE
BEVERAGE, ESPECIALLY FOR HOUSEHOLD USE**

FIELD OF INVENTION

The invention refers to a method of and an apparatus for preparing a frothy coffee beverage, especially for household use. The method and the apparatus are based on the application of low pressure in preparing coffee beverage of frothy consistency, having a natural creamy layer on the top. The proposed method comprises the known steps of heating water in a closed space compartment, generating steam from the water, pressing water by the use of the steam pressure through a batch of ground coffee for preparing a basic coffee beverage and accelerating the stream of the prepared basic coffee beverage to speed in the range from 2 m/s to 30 m/s before collecting it as frothy coffee at the outlet of the space compartment. The apparatus of the invention includes a vessel prepared for heating water, cover for sealing the vessel, a holder for receiving ground coffee, at least one filtering element, an outlet pipe and a constriction for diminishing the cross-section of the outlet on a part of its length and for accelerating the stream of a pressurised liquid to the speed range defined above.

BACKGROUND OF THE INVENTION

Numerous attempts have become known for creating an apparatus which is capable of producing frothy coffee beverage, which is a coffee beverage covered on its surface by a light coloured stable creamy layer, this layer being called further cream. A solution of this kind is shown in the European patent application No. EP-A2 0,148,982 published on July 24, 1985. The apparatus disclosed in this application contains two space compartments, eventually made in two separate vessels for preparing frothy coffee what requires the use of water of temperature below 100 °C. This apparatus ensures pressure about 250 kPa by generating steam which presses the water through a batch of ground coffee. The basic coffee beverage leaving the ground coffee is made flow through a constriction for accelerating its stream to speed in the range from about 2 m/s do 30 m/s. The disadvantage of this solution lies in the fact that because of the two space compartments an apparatus of relatively big dimensions should be applied and this is expensive. The system of transporting water in these conditions is also sophisticated. The construction can be plugged by the grains of the ground coffee and this can be dangerous.

The espresso apparatuses for preparing Italian type coffee beverage comprise sophisticated regulating systems for heating up the water. Such solutions are shown

in a plurality of patent documents. For example the German patent application published under No. DE-OS 29,52,556 discloses a mechanical system including different moving elements for regulating the heating process. This apparatus is big and its reliability is low.

- 5 The Swiss patent No CH-596,810 discloses the use of a nozzle having a restricted cross-section part of diameter about 0,5 to 1,2 mm for preparing a coffee beverage. The nozzle is a rigid construction which can be clogged by the grains of the ground coffee which inevitably leave the holder. This disadvantage is common in all of the known espresso apparatuses.
- 10 The methods and apparatuses constituting the art show the common disadvantage that they are big, expensive, the construction is included into a sophisticated system and therefore they really cannot be applied in households requiring apparatuses featured by simple way of operation and low costs.

SUMMARY OF THE INVENTION

- 15 The present invention is directed to creating a method and an apparatus whereby the frothy coffee beverage can be produced in households and in restaurants and coffee houses by simple means.

The invention is based on the recognition that only one space compartment is also sufficient for preparing high vapour pressure for pressing water through the ground coffee and further that the coffee beverage will be frothy when directing it through an opening made in a membrane element of high elasticity.

The recognition can be summarised further as follows: the traditional apparatuses for preparing coffee beverage having no frothy consistence are capable of creating the most important features of an apparatus for preparing frothy coffee if the water is heated up but not to boiling point and the low pressure steam generated from the water is applied for pressing the water through the ground coffee. The low pressure means that it is sufficient to apply pressure about 10 kPa or more for preparing the frothy coffee. Pressure in the range of about 10 kPa can be generated by water of temperature as low as 45 °C. This low temperature is sufficient for preparing the coffee beverage and if this pressure is ensured the steam used previously for pressing the water can be applied also for making the beverage. The simplest solution is to stop the heating process after reaching this temperature and this can be detected by the fact that on reaching this temperature the first droplets of the beverage can be collected, and steam begins to flow through the output of the apparatus.

35 Based on the recognition depicted above a method of and an apparatus for preparing a frothy coffee beverage were created, especially for household use. As

mentioned, frothy consistence means that the coffee beverage is covered with a light colour creamy surface layer.

The proposed method of preparing a frothy coffee beverage comprises the known steps of heating water in a closed space compartment, generating steam from the water, pressing water by the means of the steam generated through a batch of ground coffee for preparing a basic coffee beverage and accelerating the stream of the prepared basic coffee beverage to speed in the range from 2 m/s to 30 m/s before collecting it as a frothy coffee beverage at the outlet of the space compartment, wherein according to the invention the heating step is continued only up to transferring 5 a limited amount of heat energy to the water by creating conditions limiting heat transfer in water and/or by stopping the heating process during preparing the basic coffee beverage and the pressing step is carried out by the application of low pressure steam and at least one opening capable of widening and wherein further an impacting surface is arranged in the space for collecting the accelerated basic coffee 10 beverage leaving the outlet of the space compartment.

In a preferred realisation of the method of the invention the upper layer of the water is only heated in the space compartment for limiting the heat transfer, whereto especially an electric heating element immersed into water can be applied.

In a further preferred realisation of the method of the invention the heating 20 process is stopped after receiving the first droplets of the basic coffee beverage or when a previously determined amount of the basic coffee beverage has been collected, the amount being determined according to the experience won from the application of the method and the related apparatus. The stop can be done for example by manual intervention, or by the use of known electric or mechanical means.

25 The pressing step can reliably carried out when in the method of the invention generating steam of pressure in the range from about 10 kPa to about 180 kPa, preferably from about 20 kPa to about 40 kPa for pressing water through the batch of ground coffee.

In a yet further advantageous realisation of the method of the invention application of at most six openings capable of widening in the pressing step is proposed. 30

The generation of the creamy layer covering the coffee beverage, i.e. the preparation of a frothy coffee beverage is very simple in another advantageous realisation of the proposed method when impacting the basic coffee beverage into a surface of a collecting vessel under right angle or into the surface of the coffee beverage 35 earlier collected under any appropriate angle.

The apparatus for preparing a frothy coffee beverage especially in households constituting also the object of the present invention comprises a vessel prepared for

heating water, a cover for sealing the vessel, a holder for receiving a batch of ground coffee, at least one filtering element, an outlet pipe and a constriction for diminishing the cross-section of the outlet pipe on a part of its length, the construction being capable of accelerating a stream of a pressurised liquid to speed in the range from 5 about 2 m/s to about 30 m/s. According to the invention it is especially important that the apparatus in its outlet pipe is equipped with a self-regulating membrane valve system having at least one opening of non-linear operation capable of closing the outlet pipe until pressure of the pressurised liquid reaches a threshold value.

In a preferred embodiment of the apparatus proposed by the invention the 10 self-regulating membrane valve system is equipped with a valve house, a membrane of thickness in the range from about 0,01 mm to about 0,8 mm made of a material of high elasticity, especially rubber, at least one disc for adjusting the position of the membrane and a fixing ring for securing the adjusted position. This system can be easily made, e.g. a rubber membrane is punctured, wherein advantageously openings 15 of different diameters are applied.

The pressure conditions of preparing the desired frothy coffee beverage can be regulated in a very advantageous manner in a further preferred embodiment of the proposed novel apparatus, wherein the self-regulating membrane valve system is equipped with at least one and at least six valve like openings of non-linear characteristics comprised in the membrane and/or with openings of free cross-section each having cross-section area corresponding to a circle of diameter in the range from 20 about 0,05 mm to about 1,0 mm, the openings being preferably arranged in the membrane, the last openings of free cross-section being closed up to a threshold pressure value determined by the surface tension of the pressurised liquid.

25 Preferably, the membrane of the apparatus is arranged at the outlet part of the outlet pipe supported on the disc and the fixing ring, it is prepared of a material of linear characteristics in the pressure range of the pressurised liquid.

In a yet further preferred embodiment of the apparatus proposed by the invention the outlet pipe is a one-branch pipe comprising the valve house receiving or directly supporting the membrane or a more-branch pipe comprising a tap joint connected with a valve forming the outlet for forwarding the pressurised liquid.

30 The process of preparing the frothy coffee beverage is facilitated by another preferred embodiment of the novel apparatus of the invention thereby that the outlet pipe is connected with an adaptor means for cooling and dividing arranged in the way of forwarding the pressurised liquid by the application of a fix or disconnectable support, wherein advantageously the adaptor means are equipped with a lattice, mixing chamber and channels, the number of channels being between two and six.

The heating process can effectively be influenced also in conditions of open flame heating when the apparatus of the invention is prepared with vessel equipped with a flame directing element width in the range from about 15 mm to about 30 mm, the element being arranged at the bottom level of the vessel and made of material of
5 low heat conductivity.

The process and the apparatus proposed by the invention are capable of creating conditions of preparing a frothy coffee beverage whereto relatively low over-pressure is sufficient.

BRIEF DESCRIPTION OF THE DRAWINGS

10 The invention will be further described in more detail with reference to the accompanying drawings showing by way of example only some preferred embodiments of the apparatus proposed by the invention, wherein the apparatus is intended to realise also the novel method. In the drawings

Fig. 1. is a side-view of the cross-section of the apparatus as proposed,

15 Fig. 2. is a side-view of the apparatus shown in Fig. 1 partly in cross-section,

Fig. 3. is a side-view of an adapter for cooling and dividing,

Fig. 4. is the cross-section in side-view of a membrane of high elasticity applied in the apparatus, in open state and

Fig. 5. is the cross-section in side-view of the membrane of Fig. 4. in closed state.

20 DETAILED DESCRIPTION OF THE INVENTION AND PREFERRED EMBODIMENTS

The apparatus of the invention, as it is shown in the drawings constitutes a development of the traditional apparatuses for preparing espresso type coffee, and it is intended to be used especially in households, however, its principle can be applied also in professional apparatuses for cafeteria, restaurants etc.

25 As it can be seen in Fig. 1 the apparatus of the invention prepared for household use is based on a vessel 1 forming a closed space compartment sealed by a cover 12 in a housing 13. The space compartment is connected with an outlet pipe 15. During operation the space compartment is filled out with water 7 up to a level and steam 6. Within the vessel 1 under this level, near to the surface of the water 7 a heating element 8 preferably of electric system is arranged. In the outlet pipe 15 a membrane 21 made of a material of high elasticity, for example of rubber and/or at least one opening 25 are arranged, the last forming a constriction in the cross-section of the outlet pipe 15.

30 The inlet end of the outlet pipe 15 is connected with an outlet side of a holder 2 for receiving a batch of ground coffee, the holder 2 being supported on a sealing 9 in the space compartment. The holder 2 is covered on its inlet side communicating with the space compartment by the means of an inlet pipe 4 and on its

outlet side communicating directly with the outlet pipe 15 by filters 10 allowing relatively free flow of hot water and a coffee beverage. The outlet side is arranged in the case upwardly and the inlet side downwardly. The outlet pipe 15 is terminated by a pipe 26 and a tap joint 14, in the last a valve house 20 for receiving the membrane 21 can be arranged. The tap joint 14 communicates with a valve 3 and thereby with a container 11 for collecting the beverage. Within the space compartment a heating element 8 connected to a heat source or to an electric supply can be arranged and it is also advantageous to fix a flame directing element 5 to the bottom part of the vessel 1 (housing 13). The membrane 21 forms a self-regulating membrane valve of non-linear characteristics ensured either by the means of elasticity, either of surface tension or by both.

The apparatus of Fig. 1 contains the holder 2 within the space defined by the vessel 1 and cover 12. It can be arranged, however, as it is usual in the apparatuses for preparing espresso type coffee, outside of the vessel 1 as illustrated in Fig. 2. In this case the outlet pipe 15 is a short pipe section prepared in an outlet of an outer holder 27 for receiving the holder 2, commonly supported on the seal 9. The outlet of the holder 2 has in this case inlet side directed upwardly and an outlet side directed downwardly, and the valve house 20 with the membrane 21 is arranged in the mentioned short section of the outlet pipe 15.

20 The outlet pipe 15 of the apparatus can be completed at its end with an adaptor 28 (Fig. 3) for cooling and dividing the coffee beverage prepared in the apparatus. This adaptor 28 is shown in Fig. 3. It is connected with the valve house 20 and the outlet pipe 15 and is based on a support 16. It comprises a lattice 17, a mixing chamber 18 and preferably at least two and at most six channels 19.

25 In Figures 4 and 5 the most preferred embodiment of the self-regulating membrane valve system of the apparatus of the invention can be seen in opened and closed positions, respectively, wherein a valve house 20 is connected with the outlet pipe 15, it supports the membrane 21 which is made of a material of high elasticity, surrounds a disc 22 for adjusting the position of the membrane 21 and a fixing ring 23 for securing the adjusted position. Preferably, as it is shown in Figures 4 and 5 the membrane 21 is not a straight plane element, it is curved with approximately ellipsoidal or spherical shape. In the membrane 21 at least one opening 24 is arranged at its highest (or lowest) point which is closed or opened according to the conditions by the coffee beverage prepared forming a pressurised liquid. When more openings 24 are applied, they can be made by needles of different diameters. In the membrane 21 the openings 25 can b

The apparatuses shown above constitute some preferred embodiments of the invention especially for household use. The skilled artisan can design many other embodiments taking into account the important features of the apparatuses listed above and those of the method of the invention as described herein below.

5 When realising the method and the apparatus as proposed by the present invention it is important to generate steam without making water boil in its entire volume. Taking into account the known laws of physics, especially those of thermodynamics it is possible to create conditions when only the surface layer of the water is heated which can even be in boiling state without heating up the water in the layers
10 lying thereunder. This phenomenon is exploited according to the invention wherein the boiling of the water in its entire volume is avoided by applying heat convection conditions, more exactly by making use of the fact that heat convection results in heat transfer in water basically from downwards to upwards. This measure can be realised e.g. by heating the water in a closed compartment at its the upper surface. The exact
15 position of the heating element 8 (Fig. 1 and 2) can be determined on the basis of experience. It is to be taken into account that when water is arranged in a space compartment limited by metallic walls the heat transfer is ensured both by convection and by heat conductance, the last being always present. The wall of the compartment transfers heat energy from the upper part of the compartment to the water lying below.
20 This means, however, that the convection process is regularly of very low intensity, water below the level of heating will slowly be heated up only because of heat conductance of the wall. The water heated up in the lower parts ascends, it begins to flow from downside to upside. The mixed amounts of water have of course temperature determined by this flow. It is possible to create conditions when the water has
25 temperature from about 60 °C to about 62 °C, i.e. in the range which is regarded to be the most favourable for preparing the frothy coffee beverage. It should be taken into account also that the ground coffee during flow of the heated water shows changing resistance against this flow and this will be reflected in the pressure of the steam. Hence, it would be advisable design both the method and the apparatus proposed by
30 the present invention on the basis of an average pressure value.

35 The frothy coffee beverage can be prepared when a basic coffee beverage lacking bubbles is made flow with speed in the range from about 2 m/s to about 30 m/s. The speed is ensured by conducting the flow of the beverage through one or more openings 24, 25 forming a constriction in the cross-section of flow, the cross-section undergoing an increases with increasing pressure. This ability of increasing is a very important feature of the invention, however, the opening per se plays practically no role in ensuring the speed. It is well-known, the filtering processes

in the apparatuses for preparing coffee beverage ensured in the present case by the filters 10 cannot be complete. Hence, the ideal case when no grains of the ground coffee are taken by the flow of the beverage, does not exist. The small grains and some solid compounds precipitating from the ground coffee under the influence of the
5 hot water are always present in the stream of the beverage. These components do not deteriorate the taste of the coffee beverage but they are capable of clogging every rigid opening which has been applied according to the art. The openings 24 made in the membrane 21 of high elasticity can offer solution to this problem, because they do not hinder the grains of the coffee in flow through the opening. Hence,
10 by the application of the membrane 21 of high elasticity the process of making the coffee beverage is not negatively influenced. In household conditions the membrane 21 can be made e.g. by a thin rubber plate wherein a small opening 24 is made e.g. by a needle. The normal household needles make in the rubber small openings which are closed under normal conditions but open when pressure exceeding a threshold
15 limit is applied.

The frothy consistence of the coffee beverage can be ensured by impacting the coffee beverage flowing with required speed in the range from about 2 m/s to about 30 m/s to a surface wherein cavitation process takes place. This results in an unpredictable number of bubbles within the liquid and the bubbles generated collect
20 up at the surface of the beverage. They are the basic factor of coming of the creamy layer into being. According to the invention this impacting step is realised e.g. by conducting the coffee beverage to the inner surface of the space for collecting the beverage, i.e. of the container 11. It can be done also by impacting the coffee to the surface of the coffee beverage previously prepared and collected. The experiments
25 proved that it is necessary to apply speed at least about 2 m/s simultaneously with steam pressure about 10 kPa. Another solution is to apply a small opening 25 which can ensure the required speed. If this small opening 25 is made in a material of relatively high elasticity, the conditions are created where the coffee beverage can flow without hindering caused by the grains and precipitated compounds of coffee.

30 The coffee beverage can be made frothy when it is forwarded through a narrow section in the outlet pipe 15. The small cross-section of this outlet pipe part ensures that the beverage is accelerated to the required speed in the range from about 2 m/s to about 30 m/s. In these conditions the pressure is higher than the resistance of the ground coffee and the beverage can flow freely through the outlet pipe 15. At
35 the beginning of making the coffee the beverage accumulated in separate droplets, it cannot be accelerated, so the frothy consistence is not ensured. Later on the beverage is mixed with steam and the droplets of the beverage reach the container 11 for

collecting it in the form of an aerosol. If the temperature remains under about 80 °C a small amount of cream is present on the beverage. The same process takes place in the case when in the way of forwarding the coffee beverage a valve of linear operation is inserted. Hence, a valve of non-linear characteristics has become necessary

5 which has an opening 24 closed unless pressure reaches a minimal (threshold) value, i.e. which makes the beverage accumulate in the closed space before the opening 24 in the form of droplets. If the pressure is high enough, the valve opening 24 gives way for the beverage to flow with speed at least 2 m/s. The required characteristic can be realised by the membrane unit shown in Figs 4 and 5, the unit comprising a membrane 21 of thickness in the range from about 0.01 mm to about 0.8 mm. In the membrane there is at least one opening 24 closed by the elastic structure of the membrane 21 when no or low overpressure is present. So before opening the membrane 24 its material is elongated and its shape is changed. So a confusor element is created with a relatively narrow inlet part. With this way of operation the membrane 21

10 withstands the pressure at the beginning of the process and remains closed. When the pressure reaches a definite value, the opening 24 in the membrane is opened in a non-linear way, i.e. the opening 24 will be free in the moment of reaching the prescribed pressure. The confusor part of the valve is continued with a short diffusor part. The length of the two parts depends on the thickness of the membrane but the diffusor plays the role of a nozzle and together with the confusor makes the speed profile of the flow of the beverage homogeneous.

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It is also possible to prepare the apparatus with a membrane 21 having at least one free opening 25, wherein if more openings 24, 25 are applied, their cross-sections may differ. Each opening 24, 25 should be small, with a diameter at most about 1.0 mm, preferably in the range from about 0.05 mm to about 1.0 mm. The small diameter allows the surface tension of the beverage to act and the beverage itself closes the openings unless the pressure reaches a higher threshold value. The membrane 21 with free openings 25 can be arranged in the outlet pipe 15 and it operates in the same manner as the membrane 21 punctured with openings 24 .

25

30 Both mentioned solutions are advantageous because they ensure conditions where the grains of the coffee are taken by the flow of the beverage. It is advantageous when the membrane 21 is made to have at most six openings 24 prepared to be opened at different pressure values and of course it is also possible to make the membrane 21 with small free openings 25 together with the openings 24 closed when no overpressure is present. The free openings 25 may be also of different diameters

35 and this seems to be the advantageous solution.

The invention refers also to an apparatus equipped with an adaptor 28 (Fig. 3) which can cool and divide the beverage prepared. This adaptor 28 is arranged in the way of flow of the beverage, i.e. not in the closed space of the vessel 1. It comprises two to six channels 19 connected with the mixing chamber 18 and it is arranged under 5 angle about 30° or higher in relation to the horizon. The channels 19 are as wide as from about 6 mm to about 10 mm and as long as about 25 mm to about 35 mm. This angle position is necessary because the coffee beverage flows relatively slowly, it is cooled intensively, but the creamy layer on the surface of the beverage remains in the channel, the beverage without steam and bubbles flow to the container 11. The mixing 10 chamber 18 is a vessel of appropriate, e.g. not rectangular cross-section, it can comprise the beverage in a layer of height at most about 3 mm and the beverage leaving the closed chamber of the vessel 1 impacts into this layer directly or after reflecting on an appropriate surface. The upper wall of the mixing chamber ensures reflection of the beverage in direction that the beverage cannot spread out. In the mixing 15 chamber 18 the flow of the beverage is turbulent, if the stream of the beverage is directed to the surface of the beverage collected under angle differing from 90°. The stream under exactly 90° is rather difficult to realise, the angle position can be changed during the flow e.g. because of grains of coffee taken by the beverage. Therefore the mixing chamber 18 is covered with a lattice 17 of spheroid or other appropriate shape form. When impacting the beverage into the adaptor 28 the beverage 20 can flow through the lattice 17 to the mixing chamber 18 and when its direction changes the frothy consistence can be ensured thereby that the beverage impacts the saddle points of the lattice 17 consisting of thin wires of diameter from about 0.5 mm to about 0.8 mm. The saddle points of the lattice 17 are intended to modify the direction 25 of flow of the beverage, which flows partly to the beverage collected and partly to the wall of the mixing chamber 18 wherefrom it is reflected. The mixing chamber 18 has a volume from approximately 0.8 ml to about 3 ml. Its opening is preferably circular with diameter in the range from about 8 mm to about 12 mm. The lattice 17 comprises gaps of rectangular cross-section with lateral side length in the range from 30 about 1.5 mm to about 2.5 mm.

The adaptor 28 cools and divides the beverage in a way that no other cooling means are necessary when using the proposed apparatus. It is very advantageous also because if the coffee beverage is mixed with steam - this is not desired but can occur at the end of the process of making the beverage - the steam is directed away 35 from the container 11 of the beverage by the channels 19 of the adaptor 28, i.e. the steam cannot reach the frothy coffee beverage.

- In another embodiment the apparatus of the invention is equipped with an auxiliary element 5 for directing flames. This is arranged outside of the chamber and is intended to protect the apparatus against direct contact with flames. The auxiliary element 5 is a circular ring with inner diameter equal to the outer diameter of the housing 13 at its lowest (bottom) level. This element 5 has width in the range from about 15 mm to about 30 mm, the thickness is from about 0,5 mm to about 3.0 mm.
- 5 The ring shaped element 5 can be a one-layer construction or made of different heat insulating and refractive materials. In the one-layer construction of the element 5 a metal of relatively low heat conductance should be applied. It is intended to direct the
- 10 heat flow from the flames away from the side wall of the housing 13 (vessel 1) of the apparatus, thus the contents of the vessel 1 are heated up only from the bottom level of the housing 13. The heat transfer process is of convective character so water flows back to the lower layers and this means cooling thereby the lower layers when the vessel 1 is not heated from the lateral side surface.
- 15 The outer pipe of the apparatus is arranged with one or two branches. If one branch is applied the membrane valve is arranged, in the construction of more branches valve can be arranged which ensures in opened position the process of making traditional coffee.
- The apparatus works as follows:
- 20 In the vessel 1 the water 7 in amount necessary for preparing the coffee beverage is arranged. In the holder 2 between the filters 10 the ground coffee is placed and the holder 2 arranged either within the vessel 1 (Fig. 1) or in the outer holder 27 (Fig. 2) and thereafter the apparatus is closed either by the cover 12 or the outer holder 27 pressed against the seal 9. The contents of the vessel 1 are heated up
- 25 either by flame or with a heat source or a heating element 8 using electricity. It is advantageous to apply the flame directing element 5 surrounding the housing 13 of the proposed apparatus if flames are applied. The heating process is conducted until the first droplets of the beverage leave the outlet pipe 15 or it can be previously determined by experiences how much beverage should be collected in the container 11
- 30 until the heating process is stopped. Of course, it can be continued also but in this case the longer the heating process the less frothy or the shorter frothy the consistency of the coffee beverage prepared.
- The flame directing element 5 is advantageous because when it is applied the vessel 1 can be disconnected with the heat source in any moment sharply stopping
- 35 thereby the process of heating up. It is, however, disadvantageous when the heating element 8 is applied that the heating process is not sharply stopped and when it is

done too late, the frothy consistence of the coffee remains short time. The beverage is collected in the container 11 and it can be divided into portions.

The advantage of the apparatus of the invention is that it works at a pressure range being not higher than the pressure range of the traditional household apparatuses and especially at most about 40 kPa – it can be operated within the pressure range from about 10 kPa to about 40 kPa, the higher values being more preferred – it makes coffee beverage of frothy consistence covered by a creamy layer of thickness more centimetres. This thickness can be experienced when the coffee beverage is collected in a glass of diameter from about 4 cm to about 6 cm and preparing the beverage from any kind of coffee including all coffee type ground substances as coffee surrogates. The low pressure is advantageous because of safety of the household and it allows to use materials meeting not too strict conditions as for strength.

A further advantage can be seen in the fact that the beverage flows through openings which are capable of changing the cross-section area. This is important because the grains of the coffee cannot cause stopping the flow of the beverage, they are taken away by the stream.

The openings of different threshold pressure values and the free openings of different diameters ensure the conditions of homogeneous flow of the beverage, the steam can be released without problems, the beverage remains in the vessel, it bears all valuable aromatic components of the coffee bones.

CLAIMS

1. Method of preparing a frothy coffee beverage, especially for household use, comprising the steps of heating water in a closed space compartment, generating steam from the water, pressing water by the means of the steam generated through a batch of ground coffee for preparing a basic coffee beverage and accelerating the stream of the prepared basic coffee beverage to speed in the range from about 2 m/s to about 30 m/s before collecting it as a frothy coffee beverage at the outlet of the space compartment, *characterised in carrying out the heating step up to transferring a limited amount of heat energy to the water by creating conditions limiting heat transfer in water and/or by stopping the heating process during preparing the basic coffee beverage and the pressing step by the application of low pressure steam and at least one opening capable of widening and in arranging an impacting surface in the space for collecting the accelerated basic coffee beverage leaving the outlet of the space compartment.*
- 15 2. The method as set forth in claim 1, *characterised in heating the upper layer of the water in the space compartment for limiting the heat transfer, this heating step being carried out especially by the means of an electric heater immersed into water.*
- 20 3. The method as set forth in claim 1 or 2, *characterised in that the heating process is stopped immediately after receiving the first droplets of the basic coffee beverage or when a previously determined amount of the basic coffee beverage has been collected, the amount being determined according to experience.*
- 25 4. The method as set forth in any of claims 1 to 3, *characterised in stopping the heating process by manual intervention or by the use of known electric or mechanical means.*
- 30 5. The method as set forth in any of claims 1 to 4, *characterised in generating steam of pressure in the range from about 10 kPa to about 180 kPa, preferably from about 20 kPa to about 40 kPa for pressing water through the batch of ground coffee.*
- 35 6. The method as set forth in any of claims 1 to 5, *characterised in applying at most six opening capable of widening in the pressing step.*
- 30 7. The method as set forth in any of claims 1 to 6, *characterised in impacting the basic coffee beverage into a surface of a collecting vessel under right angle or into the surface of the coffee beverage earlier collected under any appropriate angle.*
- 35 8. Apparatus for preparing a frothy coffee beverage, especially for household use, comprising a vessel (1) prepared for heating water, a cover (12) for sealing the vessel (1), a holder (2) for receiving a batch of ground coffee, at least one filtering element (10), an outlet pipe (15) and a constriction for diminishing the cross-section of

the outlet pipe (15) on a part of its length, the constriction being capable of accelerating a stream of a pressurised liquid to speed in the range from about to 2 m/s to about 30 m/s, *characterised in* that the outlet pipe (15) is equipped with a self-regulating membrane valve system having at least one opening (24) of non-linear operation capable of closing the outlet pipe (15) until pressure of the pressurised liquid reaches a threshold value.

5 9. The apparatus as set forth in claim 8, *characterised in* that the self-regulating membrane valve system is equipped with a valve house (20), a membrane (21) of thickness in the range from about 0,01 mm to about 0,8 mm made of a material of high elasticity, at least one disc (22) for adjusting the position of the membrane (21) and a fixing ring (23) for securing the adjusted position.

10 10. The apparatus as set forth in claim 8 or 9, *characterised in* that the self-regulating membrane valve system is equipped with at least one and at least six valve like openings (24) comprised in the membrane (21) and/or with openings (25) of free cross-section each having cross-section area corresponding to a circle of diameter in the range from about 0,05 mm to about 1.0 mm, the openings (25) being preferably arranged in the membrane (21).

15 11. The apparatus as set forth in claim 9 or 10, *characterised in* that the membrane (21) is arranged at the outlet part of the outlet pipe (15) supported on the disc (22) and the fixing ring (23).

20 12. The apparatus as set forth in any of claims 8 to 11, *characterised in* that the membrane (21) is prepared of a material of linear characteristics in the pressure range of the pressurised liquid.

25 13. The apparatus as set forth in any of claims 8 to 12, *characterised in* that the outlet pipe (15) is a one-branch pipe comprising the valve house (20) receiving or directly supporting the membrane (21).

30 14. The apparatus as set forth in any of claims 8 to 12, *characterised in* that the outlet pipe (15) is a more-branch pipe comprising a tap joint (14) connected with a valve (3) forming the outlet for forwarding the pressurised liquid.

35 15. The apparatus as set forth in any of claims 8 to 14, *characterised in* that the outlet pipe (15) is connected with an adaptor means for cooling and dividing arranged in the way of forwarding the pressurised liquid by the application of a fix or disconnectable support (16).

36 16. The apparatus as set forth in claim 15, *characterised in* that the adaptor means are equipped with a lattice (17), mixing chamber (18) and channels (19), the number of channels being between two and six.

17. The apparatus as set forth in any of claims 8 to 15, characterised in that vessel (1) is equipped with a flame directing element (5) of width in the range from about 15 mm to about 30 mm, the element being arranged at the bottom level of the vessel and made of material of low heat conductivity.

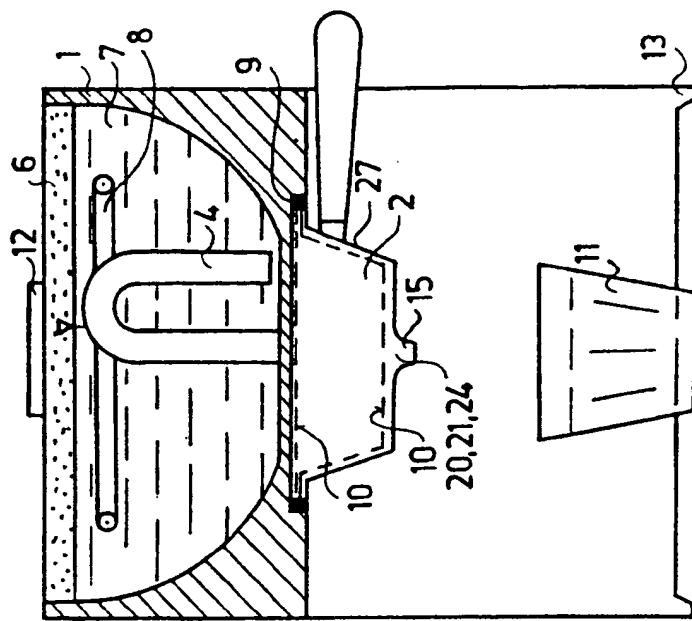


Fig. 2

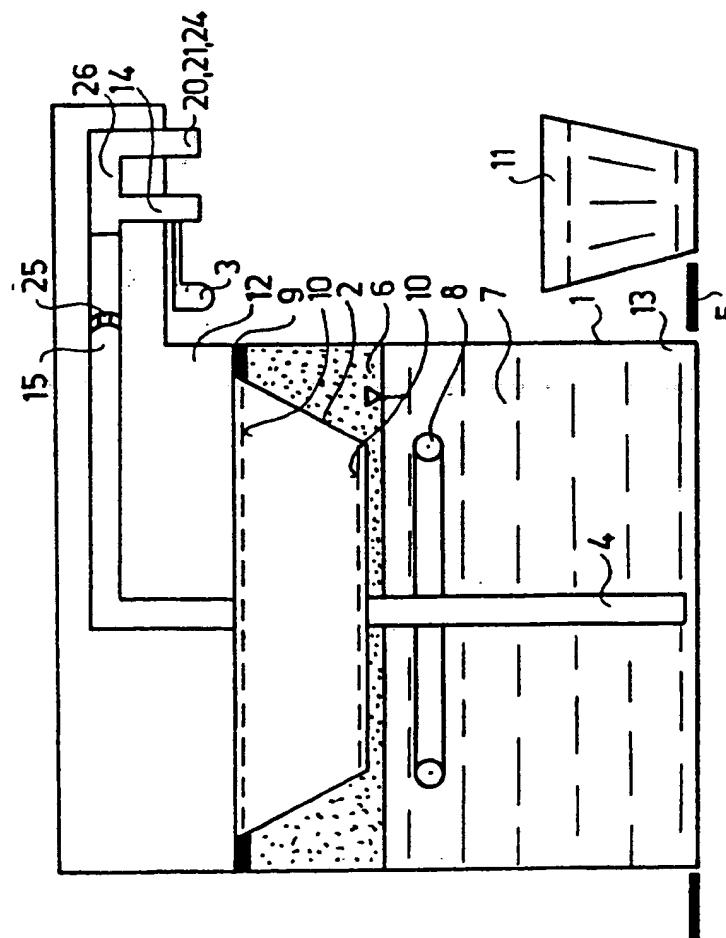


Fig. 1

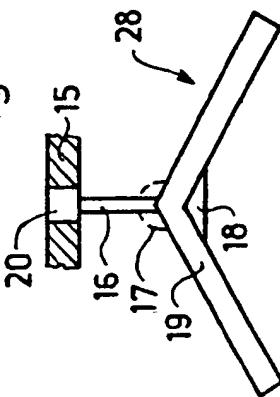


Fig. 3

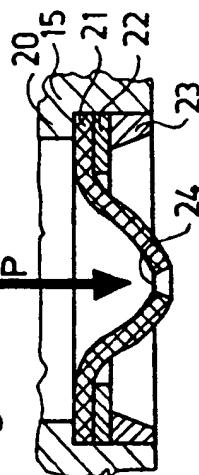


Fig. 4

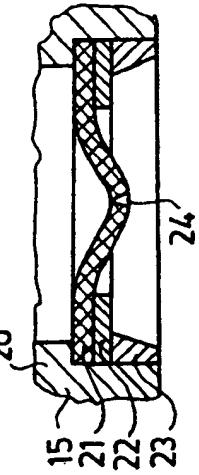


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/HU 93/00070

A. CLASSIFICATION OF SUBJECT MATTER

IPC⁵: A 47 J 31/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC⁵: A 47 JDocumentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AT

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP, A2, 0 472 272 (CAFFE ACORTO) 26 February 1992 (26.02.92), abstract.	1,8
A	EP, A1, 0 162 305 (POCCINO-ESPRESSO) 27 November 1985 (27.11.85), abstract.	1,8
A	EP, A2, 0 148 982 (ALKOTO IFJUSAG) 24 July 1985 (24.06.85), claims 1,7 (cited in the application).	1,8
A	WO, A1, 85/03 852 (BENDINI) 12 September 1985 (12.09.85), abstract.	1,8
A	CH, A5, 596 810 (EGLOFF & CIE) 31 March 1978 (31.03.78), claims (cited in the application).	1,8

Further documents are listed in the continuation of Box C. See patent family annex.

- * Special categories of cited documents:
- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed
- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search 17 February 1994 (17.02.94)	Date of mailing of the international search report 28 June 1994 (28.06.94)
Name and mailing address of the ISA/ AT AUSTRIAN PATENT OFFICE Kohlmarkt 8-10 A-1014 Vienna Facsimile No. 1/53424/535	Authorized officer Reif e.h. Telephone No. 1/5337058/27

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/HU 93/00070

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